

WHAT IS CLAIMED IS:

1. An information encoding apparatus comprising:

converting means for converting an input signal into a spectrum signal;

removing means for removing the spectra of frequencies having levels below a minimum audible level curve among spectra converted by the converting means;

first determining means for determining whether predetermined first frequency spectrum level and second frequency spectrum level are both above the minimum audible level curve;

second determining means for determining whether one of the first frequency spectrum level and the second frequency spectrum level is below the minimum level if the first and second frequency spectrum levels are switched after the first determining means determines that the first frequency spectrum level and the second frequency spectrum level are both above the minimum audible level curve;

adding means for adding information by controlling to switch or not to switch the spectra on the basis of the information to be added if the second determining means determines that one of the first frequency spectrum level and the second frequency spectrum level is below the minimum audible level curve when the first and second frequency

spectrum levels have been switched; and

encoding means for encoding a spectrum to which information has been added by the adding means.

2. The information encoding apparatus according to Claim 1, wherein

the encoding means comprises:

means for determining a minimum value and a maximum value of the input signal for each predetermined unit;

dynamic range calculating means for calculating a dynamic range for each predetermined unit from the maximum value and the minimum value for each predetermined unit;

difference computing means for determining a difference between the input signal and the minimum value and outputting the determined difference; and

a quantizing means for quantizing the determined difference on the basis of the calculated dynamic range and outputting a quantized result.

3. An information encoding method for an information encoding apparatus, comprising:

a converting step for converting an input signal into a spectrum signal;

a removing step for removing the spectra of frequencies having levels below a minimum audible level curve among

spectra converted by processing in the converting step;

a first determining step for determining whether predetermined first frequency spectrum level and second frequency spectrum level are both above the minimum audible level curve;

a second determining step for determining whether one of the first frequency spectrum level and the second frequency spectrum level is below the minimum level if the first and second frequency spectrum levels have been switched after the processing of the first determining step determines that the first frequency spectrum level and the second frequency spectrum level are both above the minimum audible level curve;

an adding step for adding information by controlling to switch or not to switch the spectra on the basis of the information to be added if the processing of the second determining step determines that one of the first frequency spectrum level and the second frequency spectrum level is below the minimum audible level curve when the first and second frequency spectrum levels have been switched; and

an encoding step for encoding a spectrum to which information has been added by the processing of the adding step.

4. A recording medium in which a computer-readable

program for an information encoding apparatus has been recorded, the program comprising:

- a converting step for converting an input signal into a spectrum signal;

- a removing step for removing the spectra of frequencies having levels below a minimum audible level curve among spectra converted by the processing in the converting step;

- a first determining step for determining whether predetermined first frequency spectrum level and second frequency spectrum level are both above the minimum audible level curve;

- a second determining step for determining whether one of the first frequency spectrum level and the second frequency spectrum level is below the minimum level if the first and second frequency spectrum levels have been switched after the processing of the first determining step determines that the first frequency spectrum level and the second frequency spectrum level are both above the minimum audible level curve;

- an adding step for adding information by controlling to switch or not to switch the spectra on the basis of the information to be added if the processing of the second determining step determines that one of the first frequency spectrum level and the second frequency spectrum level is below the minimum audible level curve when the first and

second frequency spectrum levels have been switched; and  
an encoding step for encoding a spectrum to which  
information has been added by the processing of the adding  
step.

5. A program of a computer for controlling an  
information encoding apparatus, comprising:

a converting step for converting an input signal into a  
spectrum signal;

a removing step for removing the spectra of frequencies  
having levels below a minimum audible level curve among  
spectra converted by processing of the converting step;

a first determining step for determining whether  
predetermined first frequency spectrum level and second  
frequency spectrum level are both above the minimum audible  
level curve;

a second determining step for determining whether one  
of the first frequency spectrum level and the second  
frequency spectrum level is below the minimum level if the  
first and second frequency spectrum levels have been  
switched after the processing of the first determining step  
determines that the first frequency spectrum level and the  
second frequency spectrum level are both above the minimum  
audible level curve;

an adding step for adding information by controlling to

switch or not to switch the spectra on the basis of the information to be added if the processing of the second determining step determines that one of the first frequency spectrum level and the second frequency spectrum level is below the minimum audible level curve when the first and second frequency spectrum levels have been switched; and

an encoding step for encoding a spectrum to which information has been added by the processing of the adding step.

6. An information decoding apparatus, comprising:

decoding means for decoding an input signal;

first determining means for determining whether only one of a first frequency spectrum level and a second frequency spectrum level of a signal decoded by the decoding means is below a minimum audible level curve;

second determining means for determining whether only one of the first frequency spectrum level and the second frequency spectrum level is below the minimum level when the first and second frequency spectrum levels are switched; and

reproducing means for reproducing added information on the basis of determination results of the first determining means and the second determining means.

7. The information decoding apparatus according to

Claim 6, wherein

the input signal is a signal obtained by quantizing a minimum value of a signal for every predetermined unit, a dynamic range of the signal for the every predetermined unit and a difference between the signal and the minimum value for the every predetermined unit on the basis of the dynamic range, and

the decoding means comprises:

inverse quantizing means for calculating a quantizing step width from the dynamic range, inversely quantizing the quantized signal and outputting the inversely quantized signal; and

adding means for adding the minimum value to the inversely quantized signal.

8. An information decoding method for an information decoding apparatus, comprising:

a decoding step for decoding an input signal;

a first determining step for determining whether only one of a first frequency spectrum level and a second frequency spectrum level of a signal decoded by the processing of the decoding step is below a minimum audible level curve;

a second determining step for determining whether only one of the first frequency spectrum level and the second

frequency spectrum level is below the minimum level when the first and second frequency spectrum levels are switched; and

a reproducing step for reproducing added information on the basis of determination results obtained by the processing of the first determining step and the second determining step.

9. A recording medium in which a computer-readable program for an information decoding apparatus has been recorded, the program comprising:

a decoding step for decoding an input signal;

a first determining step for determining whether only one of a first frequency spectrum level and a second frequency spectrum level of a signal decoded by processing of the decoding step is below a minimum audible level curve;

a second determining step for determining whether only one of the first frequency spectrum level and the second frequency spectrum level is below the minimum level when the first and second frequency spectrum levels are switched; and

a reproducing step for reproducing added information on the basis of determination results obtained by the processing of the first determining step and the second determining step.

10. A program of a computer for controlling an



information decoding apparatus, comprising:

- a decoding step for decoding an input signal;

- a first determining step for determining whether only one of a first frequency spectrum level and a second frequency spectrum level of a signal decoded by the processing of the decoding step is below a minimum audible level curve;

- a second determining step for determining whether only one of the first frequency spectrum level and the second frequency spectrum level is below the minimum level when the first and second frequency spectrum levels are switched; and

- a reproducing step for reproducing added information on the basis of determination results obtained by the processing of the first determining step and the second determining step.